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AUTHOR Croft, Cedric
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ABSTRACT

Non-verbal tests are paper-and-pencil tests that are designed to measure cognitive processes that do not involve verbal language. Such tests use shapes, patterns, diagrams, and sequences to measure general intellectual skills of a non-verbal nature. The use of such tests in schools is described. Performance tests using concrete apparatus are distinguished from these paper-and-pencil non-verbal tests. Major assumptions underlying the use of these tests include: (1) non-verbal tests tap a set of thinking skills basic to intellectual functioning and measure general intelligence; (2) non-verbal tests are more valid measures of the school potential of the low achiever than are verbal tests; and (3) non-verbal tests are culture free. None of these assumptions can be supported. Non-verbal tests appear to measure in the broad domain of intelligence and cannot be disregarded entirely. They are legitimate aids in determining the range and strength of an individual's cognitive abilities, particularly for career planning. It is important to recognize that non-verbal tests provide information for use in conjunction with a variety of sources. (SLD)

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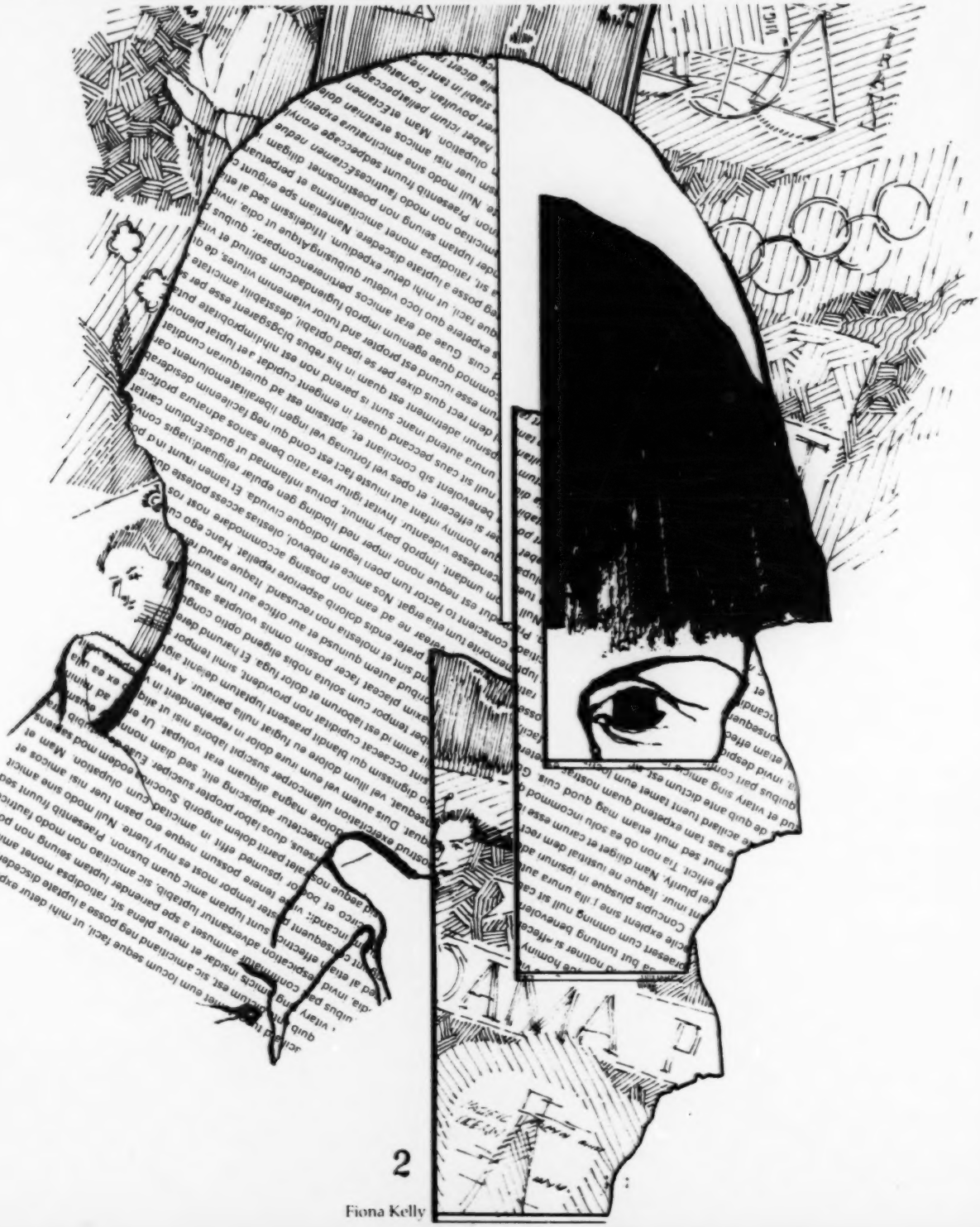

Fiona Kelly

Non-Verbal Tests in Schools

By Cedric Croft
NZCER

Non-Verbal Tests

The term 'non-verbal test' is used to describe a range of paper-and-pencil tests designed to tap a selection of cognitive processes that are unlikely to involve verbal language. This does not mean that verbal instructions and verbal strategies have been entirely eliminated for all those who take these tests; it simply means that no words are included in the tests, the test content is of a non-verbal nature, and the responses to this content are unlikely to involve language.

Examples are the *Standard Progressive Matrices*, *Jenkins Non-Verbal*, *ACER Junior Non-Verbal*, the *IPAT Culture Fair Tests* and the *NFER Non-Verbal Tests*. All of these tests attempt to measure general intellectual skills of a non-verbal nature by utilizing shapes, patterns, diagrams and sequences. The use in schools of tests such as these is the focus of this article.

Performance and Apparatus Tests

There is a whole range of performance or apparatus tests widely used in psychological assessment which involve no verbal answers. The best known tests containing performance items are the *Wechsler Intelligence Scale for Children – Revised* (object assembly, block design) the *Revised Stanford Binet Form LM* (bead threading, paper cutting) and the *British Ability Scales* (block design, rotation of letter-like forms). The content of performance or apparatus tests is typically non-verbal, but the one-to-one administration of these tests, is a highly verbal process. It is the concrete apparatus that leads to performance tests being classified as a category that is separate and quite distinct from non-verbal paper and pencil measures.

Non-Language Tests

Some writers make a valid distinction between the true non-verbal test, and others that can be termed non-language, non-reading or pictorial tests. This distinction is useful, as non-language tests require no verbal language at all, and can be used for foreign-speaking, deaf and illiterate subjects. It can be misleading to call this sort of test non-verbal, since the term should only apply to the test *content* and not the subject's *behaviour*. Tests of verbal comprehension and vocabulary can be administered through the use of pictorial content, the outcome being that underlying verbal abilities are measured by tests with a content devoid of verbal material. Non-language tests are rarely used outside a cross-cultural setting, because in other settings examiners and subjects usually have some knowledge of a common language. The *Army Beta Tests*, previously used in large scale induction and recruiting in the United States, the range of tests used for selection in South African industry and the *Queensland Test*, are prominent examples of non-language tests.

The Characteristics of Non-Verbal Tests

Non-verbal tests:

(i) have a non-verbal content;
(ii) are in paper-and-pencil format;
(iii) have no apparatus;
(iv) are suitable for group administration;
(v) do not incorporate writing responses;
(vi) use oral language in administration;
(vii) tap cognitive processes unlikely to involve verbal language.

Why are Non-Verbal Tests Used?

The short answer is that non-verbal tests are seen as measures of 'ability' unconstrained by language, and because of this, it would seem that they can be used to measure cognitive functioning without being, as most tests are, dependent on language achievement. Non-verbal tests are thought to be of most value for testing children who are non-native speakers of English, or children whose measured verbal attainment is fairly minimal. But this takes a number of points for granted. What are the major assumptions underlying the uses of non-verbal tests in schools? Can these assumptions, and hence the uses of the tests, be justified?

Assumption 1: Non-verbal tests tap a set of thinking skills basic to all intellectual functioning, so they are measures of general intelligence.

It is wrong to assume that non-verbal tests measure the same cognitive functions as verbal tests, no matter how similar they appear to be. Spatial analogies are more than a non-verbal version of verbal analogies. The form of the relationships differ, the elements that lead to the perception of points of similarity differ and the level of thinking used to deduce the relationship is set at different levels.

Tests like the *Standard Progressive Matrices* and other similar non-verbal tests, have been designed to measure a broad selection of reasoning tasks and abstract conceptualization, but factor analytic studies have indicated that separate non-verbal factors are the greatest contributors to the scores. This suggests that the non-verbal abilities being sampled by these tests are largely distinct from the general verbal-educational (g,v:ed) factor being measured by verbal tests. However, it is probably misleading to think of verbal and non-verbal abilities as being entirely distinct. As verbal and non-verbal abilities are aspects of the broader group of skills now commonly referred to as scholastic aptitude (formerly 'intelligence', 'general intelligence', 'general ability', 'mental ability', 'general mental ability') it is probably more realistic to think of these abilities as two broad divisions of human intellect composed of a number of identifiable skills, with some general elements in common.

Studies of the relationships between measures of school achievement, scholastic aptitude tests and non-verbal tests, also shed some light on the relationships between non-verbal tests, and general intelligence. Typically, achievement tests sampling predominantly verbal skills (reading comprehension, vocabulary,study skills, spelling, writing skills) correlate more highly with measures of general intelligence (.80) than with non-verbal tests (.60). Mathematics involving problem solving also relates more highly to verbal than non-verbal tests, but aspects of mathematics stressing spatial skills, i.e. geometry, show a more positive relationship with non-verbal tests.

Assumption 1 cannot be supported. Non-verbal tests are not measures of general mental ability. Non-verbal tests are measures of the broad domain of non-verbal abilities, and cannot be used as valid measures of the intellectual skills associated with most of the highly verbal tasks commonly encountered in much classroom learning.

Assumption 2: Non-verbal tests are more valid measures of the school potential of the low-achiever than verbal tests.

Non-verbal tests are most certainly valid measures of non-verbal abilities, but this class of abilities is little utilized in most school learning. Non-verbal tests do not lack validity *per se*, but their validity is suspect when they are used to predict possible future achievement in verbal areas of the school curriculum. When the tests are used to predict verbal learning, there is a mismatch between the skills measured by the test and the abilities that underlie the learning. This cannot enhance test validity, as the tests are measuring something different from the skills and abilities underlying the intended achievement.

There is a widespread belief that poor readers who score well on a non-verbal test are likely to succeed in a remedial reading course as they have demonstrated a potential previously untapped by verbal measures. They may of course show very gratifying progress, but it is unlikely that such progress is due to the presence of the abilities measured by a non-verbal test. Reading is obviously a highly verbal set of skills and the abilities underlying this process are similar to those measured by verbal tests. There is little basis for the belief that non-verbal tests are satisfactory predictors of reading achievement, particularly of comprehension skills.

Where non-verbal test performance is very much better than verbal test performance it is tempting to infer that the non-verbal test is the more valid measure of underlying abilities, and that results from the verbal test represent a form of underachievement. It is then surmized that, given a different set of environmental circumstances, performance on a verbal test may have been nearer to the results of the non-verbal test. However, if you want to estimate an individual's present functioning and the likelihood of their progress in reading in the near future, a verbal test is best. It will tap present accomplishments in the skills that underlie reading. The hypothesis advanced was tempting, and widely differing scores may suggest a need for long term intervention, but for the purposes of planning for immediate short-term needs, verbal tests provide the more valid information.

There is one important exception to this general conclusion. In the case of students whose English is limited, there can be justification for using non-verbal tests. Verbal tests will only be valid if the subject has had considerable exposure to, and experience of, the language of the tests. If there was a need to undertake an assessment of a recently arrived child from Europe, Asia, or the Pacific, a child with little experience of English, a non-verbal test could give some very general notion of broad intellectual status. A verbal test in English would have little or no validity. In a situation such as this, it would be preferable to have any assessments made by an experienced psychologist who would have access to a range of valid tests.

Assumption 2 cannot be justified: Particularly in the short term, and provided the individual has knowledge and experience of the language medium being used, verbal tests are better predictors of most school achievement than existing non-verbal measures. Significantly better non-verbal scores may indicate cases of verbal underachievement, but the type of intervention required is beyond the resourses of most schools, and it is likely that the optimum stage for learning such skills is well past.

If non-verbal tests are to be used successfully in the way many teachers want, new tests with appropriate validating criteria must be constructed.

Assumption 3: Non-verbal tests are culture free.

There is a large body of evidence to suggest that non-verbal and performance tests may be *more* culturally biased than language tests. Cole and Hunter found the WISC Performance Scale to be as difficult as the Verbal Scale for a group of Negro children in the United States, despite the apparent cultural bias in many of the vocabulary, information and comprehension items, comprising the WISC Verbal Scale. Higgins and Sivers found that, when the *Revised Stanford Binet Form LM* and the *Coloured Progressive Matrices* were compared for a matched group of 7–9 year old Negroes and Caucasians, there were no significant differences in the Binet scores, but on the *Coloured Progressive Matrices* the Negro group did significantly *worse*. Vernon in 1965 reported that Jamaican boys scored better on conventional verbal intelligence and achievement tests, despite their linguistic disadvantage, than they did on non-verbal tests that appeared to be a 'purer' measure of general mental ability.

As non-verbal tests are apparently based on a white middle-class conception of 'logical thinking', should they be regarded as culture free? Cohen has suggested that there are two basic cognitive styles, analytic and relational, both regarded as independent of general mental ability, able to be defined without reference to specific content but, to some extent at least, influenced by social and cultural factors. If Cohen is right and the analytic cognitive style is implicit in non-verbal tests developed by white middle-class psychologists, the appropriateness of these tests for cultural groups that operate with a relational cognitive style, must be questioned.

Vernon has suggested that the group of skills we refer to as intelligence, or general mental ability, is bound up with convergent problem solving, persistence, initiative and efficiency. It is the type of ability well adapted to scientific analysis, control and exploration of the environment, large-

scale and long term planning and carrying out materialistic objectives. This has led to growth of complex social institutions (nations, armies, multi-national companies, school systems) but has been less successful in promoting solutions to group rivalries, or harmonious personal adjustment, than skills which would be called 'intelligence' by some cultures we regard as more primitive. If Vernon's suggestions are correct, and conceptions of intelligence differ from culture to culture, there must be little prospect of being able to use tests from one culture, as valid measures of the trait of intelligence, within another culture.

Major writers in the field of psychological testing agree that there is no such thing as a 'culture fair' or 'culture free' test, especially since there is no universal culture that test items can validly measure. 'Culture fairness' is not an either-or attribute but rather a number of dimensions along which various aspects of tests can range, and so is a matter of degree.

Assumption 3 cannot be justified. No test is culture free.

Do Non-Verbal Tests Measure Intelligence?

There is no simple, unequivocal answer to this question as it stands, as any conclusions depend very much on your definition of intelligence.

If intelligence is regarded as a broad grouping of cognitive skills manifested by the ability to see relationships, deduce similarities, solve problems, predict consequences, reason logically and generally manipulate a variety of symbols and the ideas they represent, non-verbal tests will be recognized as sampling *some* of these skills. Consequently, non-verbal tests will be viewed as a measure of some aspects of intelligence.

How do these tests relate to school learning? In the broadest sense, school learning is a result of interaction between the intelligence of the learner and the school curriculum. If we call the aspects of intelligence associated most closely with school learning 'scholastic aptitude', we must ask whether non-verbal tests are also measures of scholastic aptitude? It is unlikely that non-verbal abilities are a predominant aspect of the range of skills and abilities referred to as 'scholastic aptitude' because school learning is predominantly verbal.

To return to the question – do non-verbal tests measure intelligence? In the writer's view, non-verbal tests measure in the broad domain of intelligence, but when we are thinking of school learning we are most concerned with aspects of intelligence that can be categorized as 'scholastic aptitude'. While non-verbal tests are not comprehensive measures of scholastic aptitude, they cannot be disregarded entirely, particularly if it is accepted that non-verbal tests measure some aspects of intelligence.

What *are* the Legitimate Uses of Non-Verbal Tests?

Within the school context, non-verbal tests are most useful in guidance. They can be an aid in determining the range and strength of an individual's cognitive abilities, as a first step in career planning. Not every student who seeks guidance about future careers should be administered a non-verbal test. These tests should be among the resources available to a counsellor, along with interest inventories, tests of specific abilities (e.g., computer programmer aptitude, clerical and office skills, mechanical aptitude) tests of scholastic aptitude, measures of attitudes and personal adjustment. Non-verbal tests are no more, or no less important, than these other categories of tests. The key to their utility is knowing when they will provide valid measurements and when they can be used with profit.

In the case of a student with mediocre verbal achievement and significantly higher non-verbal test scores, a case could be made for this student to follow a secondary or tertiary course that utilizes non-verbal strengths, i.e., technical drawing, practical engineering or building. The associated difficulty is that although courses such as these utilize non-verbal skills, much of the associated instruction is undertaken by verbal means.

When you cannot use a verbal test, for example your pupil has recently arrived from overseas and you have no tests in his or her language, a non-verbal test may give you an approximate measure of intellectual status and possible achievement in the short term. It would be unwise to attach too much weight to these results, but in this situation non-verbal tests do enable a preliminary assessement of non-English speaking students to proceed.

These tests, like any other, provide specific information to be used in conjunction with information from a variety of sources. Provided non-verbal test scores are accepted as measures of non-verbal skills, they have a role to play. If they are thought of as a measure of a broad general ability that underlies school learning, they will be less useful. If they are regarded as being predictive of highly verbal school learning, they will be downright misleading.

Notes

Evidence that non-verbal tests are not culture free can be found in
Cole, S. and Hunter, M. 'Pattern Analysis of WISC Scores Achieved by Culturally Disadvantaged Children.' *Psychological Reports*, Vol. 29, pp.242–251, 1971.

Higgins, C. and Sivers, C. 'A Comparison of Stanford-Binet and Coloured Raven Progressive Matrices IQs for Children with Low Socioeconomic status.' *Journal of Consulting Psychology*, Vol.22, pp.465–468, 1958.

For discussion of why non-verbal tests are not culture free see
Cohen, R.A. 'Conceptual Styles, Culture Conflict and Nonverbal Tests of Intelligence.' *American Anthropologist*, Vol.71, pp.828–856, 1969.
Vernon, P.E. 'Ability Factors and Environmental Influences.' *American Psychologist*, Vol.20, pp.723–733, Sept. 1965.

Further reading

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Anastasi, Anne. *Psychological Testing* 4th Edition New York: Macmillan, 1976.